Al-Mustaqbal University

Collage of Engineering

Prosthetics and Orthotics Engineering

Third Stage

ORTHOTICS II

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Elbow Immobilization Splints

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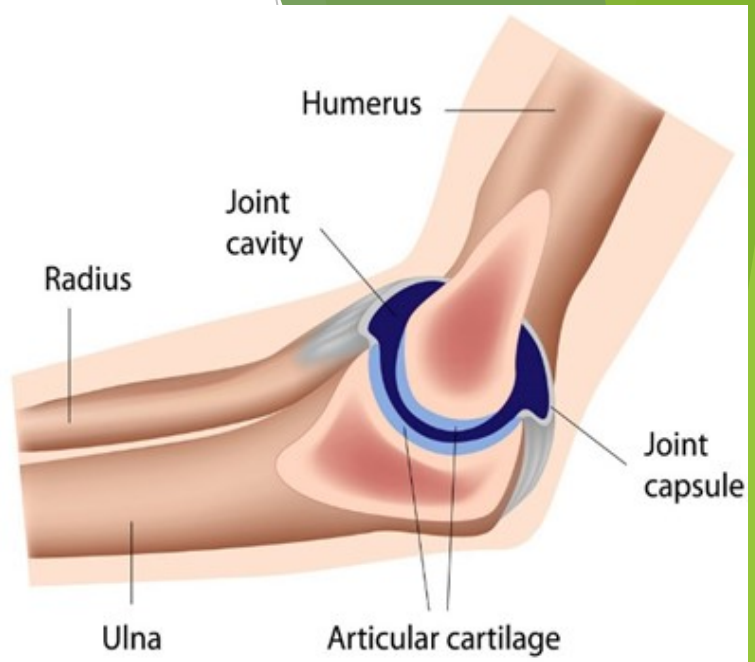
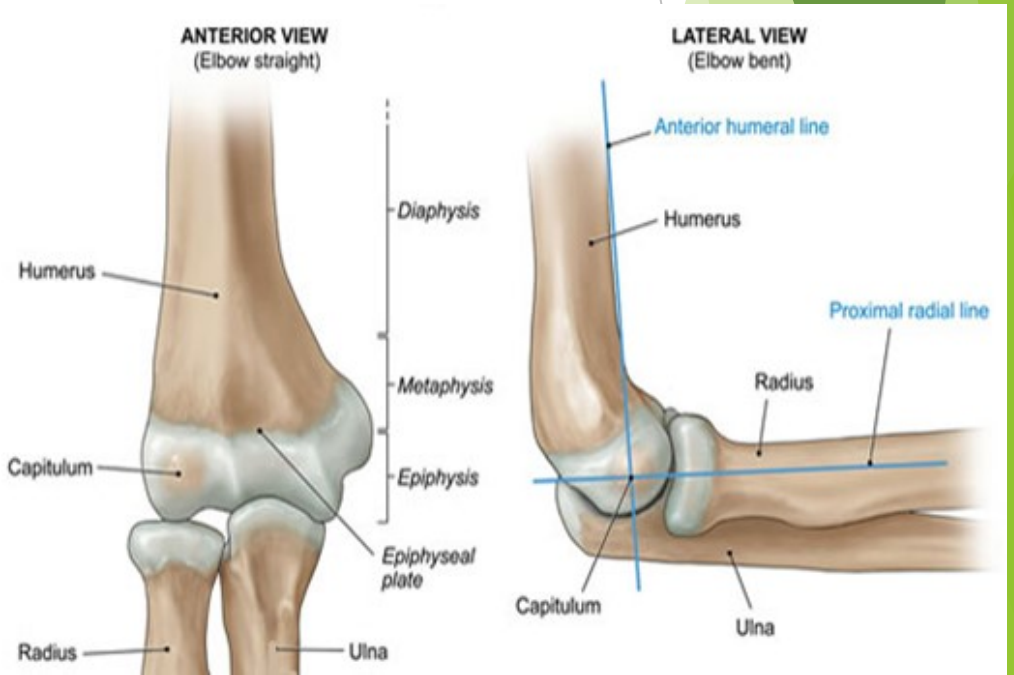
Anatomic and Biomechanical Considerations

- The elbow joint consists of three bones: distal humerus, proximal ulna (olecranon process), and the head of the radius.
- The elbow joint is comprised of three complex articulations: ulna-humeral, radio-capitellar, and proximal radio-ulnar.
- Flexion and extension of the elbow occur at the ulna-humeral joint. Flexion, extension, and rotation occur at the radio-humeral joint.
- Forearm rotation occurs at the proximal and distal radioulnar joints along a longitudinal axis.



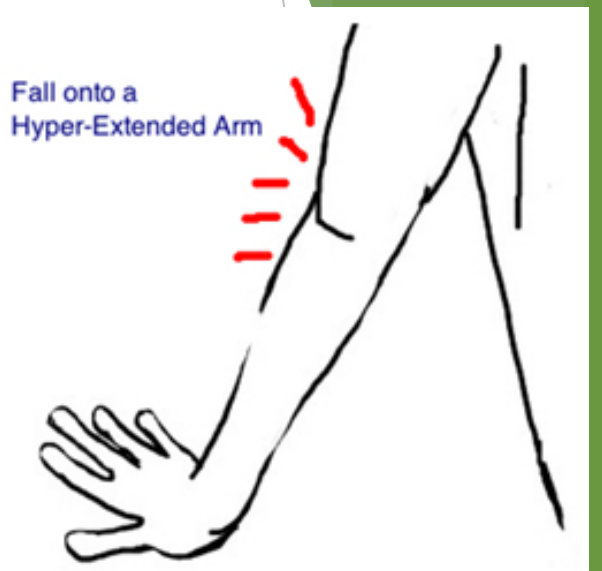


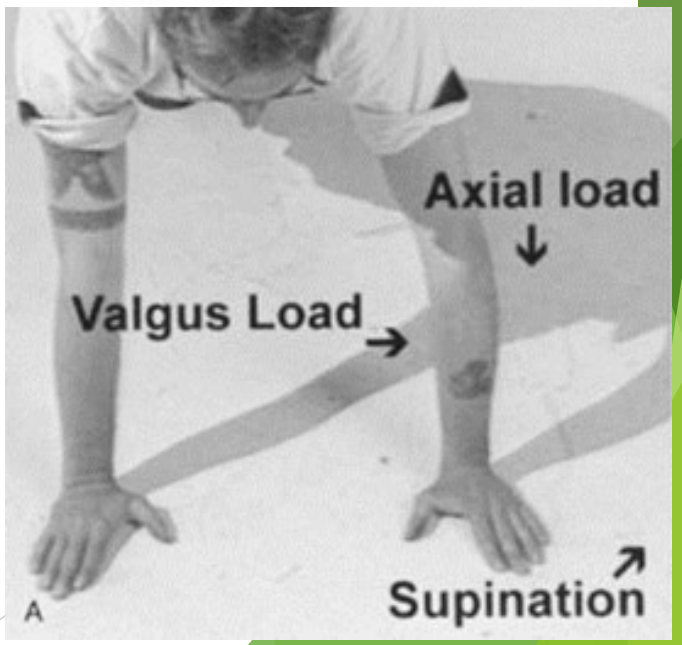
Clinical Indications and Diagnoses

- Splints are commonly constructed for:
  - Elbow fractures,
  - Elbow arthroplasty,
  - Elbow instability,
  - Biceps and triceps repair,
  - Cubital tunnel syndrome.

Splinting For Fractures

- Elbow trauma can result in a simple one-bone fracture or a complex fracture/dislocation involving a combination of bones.
- Elbow dislocations occur in isolation or along with a fracture.
- Both fractures and dislocations often include concomitant soft-tissue injury such as ligament, muscle, or nerve.
- Seven percent of all fractures are elbow fractures, and of this one-third involve the distal humerus.
- The mechanism of injury is a posterior force directed at the flexed elbow, often a fall to an outstretched hand, or axial loading of an extended elbow
- Elbow fractures are managed conservatively with closed immobilization and surgically with open reduction internal fixation (ORIF) or external fixation.





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- Healing structures are protected in a brace, cast, or custom-molded thermoplastic splint to maintain alignment and prevent deformity.
- The protective splint is worn for as long as 2 to 8 weeks postoperatively, depending on the stability of the fracture/joint and the severity of the injury. The position and angle of immobilization are based on the type of fracture.
- Distal humeral fractures are immobilized in 90 degrees of elbow flexion, with the forearm in neutral rotation.
- Olecranon and proximal ulna fractures often involve injury to the triceps tendon. To protect the injured tendon, the elbow is immobilized in 60 to 70 degrees of flexion, the forearm in neutral, and the wrist in slight extension.
- Complex radial head fractures/dislocations and radial head replacements are immobilized in up to 120 degrees of flexion to stabilize the radial head.

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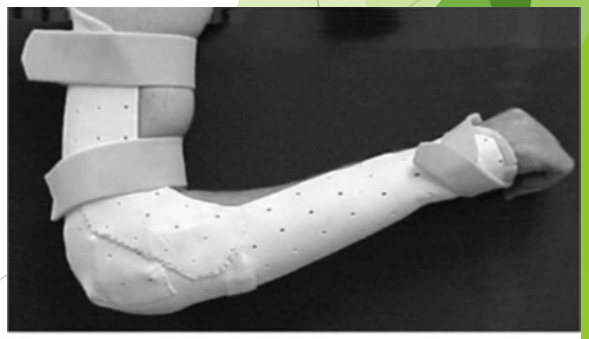

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Splinting For Total Elbow Arthroplasty

- Elbow arthroplasty refers to resurfacing or replacement of the joint.
- The primary goal of total elbow arthroplasty is pain relief with restoration of stability and functional motion (arc of 30 to 130 degrees).
- An elbow replacement is considered when the joint is painful, is restricted in motion, or has destroyed articular cartilage.
- Total elbow arthroplasty includes three types of implants: constrained, non-constrained, and semi-constrained.
- The choice for a specific implant is based on the extent and cause of the disease, the specific needs of the client, and the surgeon's preference.

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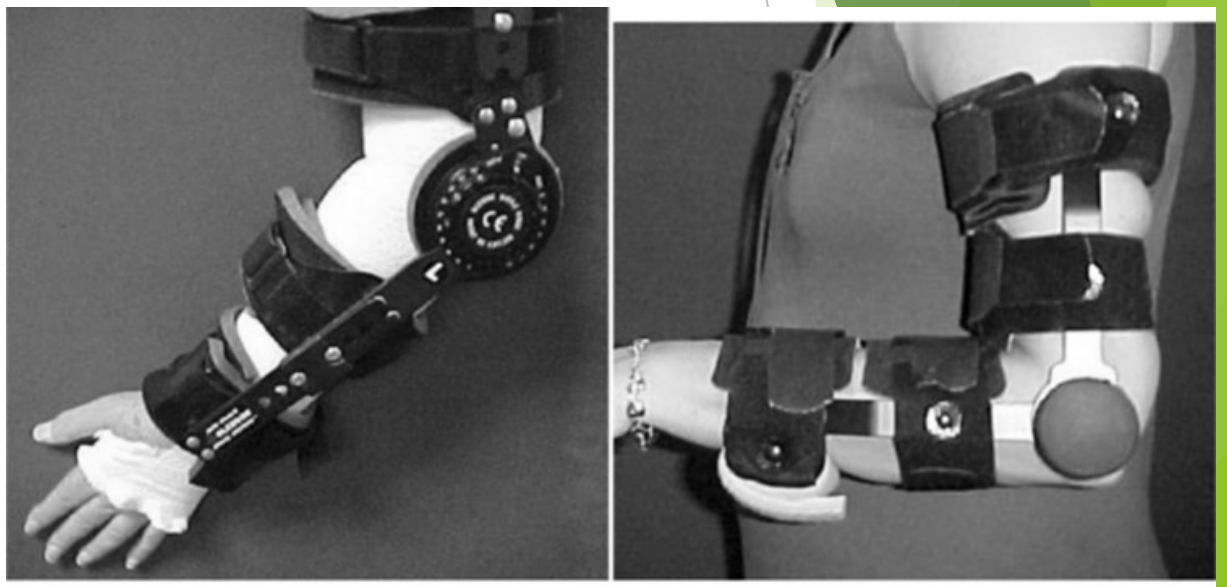
- Some surgeons prefer a brace such as the Bledsoe brace or Mayo Elbow Universal Brace
- The brace provides medial and lateral stability while allowing flexion and extension of the elbow.
- The parameters of the brace are preset to limit end range in both flexion and extension.
- Extension is set to tolerance, and flexion is determined by the condition of the triceps muscle and surgical repair. Protected range of motion exercises are initiated with the brace on for 2 to 3 weeks.



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- Another common option is a posterior elbow immobilization splint, a custom-molded thermoplastic splint positioned in 80 to 90 degrees of flexion.
- The advantages of this splint are that it fits well by conforming to the client's elbow and that it can be remolded to accommodate changes in edema.
- Disadvantages of the splint include posterior pressure at the incision site and development of an elbow flexion contracture if the splint is not removed regularly for exercise.
- The splint is removed 3 to 4 times daily for the performance of protected range-of-motion exercises.

Splinting For Instability

- Elbow instability results from a dislocation of the ulna-humeral joint and injury to the varus and valgus stabilizers of the elbow and the radial head.
- This injury often results from a forceful fall on an outstretched hand. The impact drives the head of the radius into the capitellum of the humerus.
- This may result in radial head and coronoid process fracture, medial collateral, and posterolateral and/or lateral collateral ligament disruption. When all of these structures are injured, the condition is described as the “terrible triad”.
- The treatment plan begins with fabrication of a custom thermoplastic posterior elbow shell with the elbow positioned in 120 degrees or more of flexion and the forearm in full pronation.
- The wrist is included and splinted in neutral. A figure-of-eight strap may be added to further stabilize the elbow in 120 degrees for a larger-framed individual. The splint is worn at all times and removed 3 to 5 times daily for protected exercises.

Splinting For Biceps and Triceps Rupture

- Distal biceps tendon rupture is uncommon and occurs more frequently in men than in women.
- The mechanism of injury is a strong extension force applied to the elbow in the flexed position, such as attempting to catch a heavy object with an outstretched hand.
- Treatment varies from immobilization to surgical repair. Common methods of immobilization include a brace or posterior elbow splint locked at 90 degrees of flexion and the forearm immobilized in pronation.

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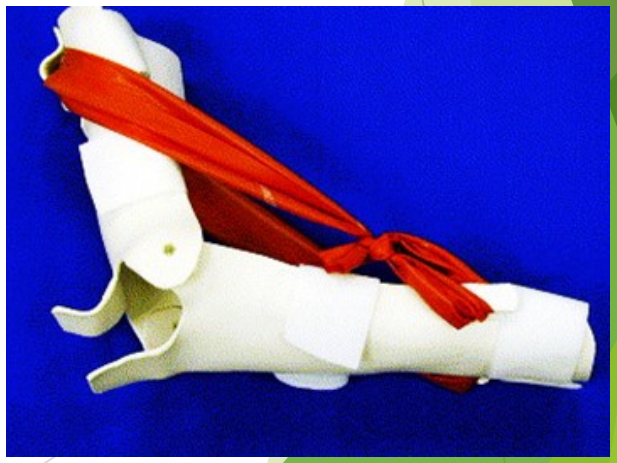
- Some physicians prefer that the forearm be immobilized in neutral rotation, and yet others immobilize in supination.
- Elbow flexion is permitted as tolerated from the locked position of 90 degrees.
- Three weeks postoperatively elbow extension is increased by 10 to 15 degrees per week.
- The brace is generally worn for a period of 6 to 8 weeks. The benefit of using a brace for biceps tendon repairs is that it is easily adjusted to accommodate the change in the angle of motion.
- A thermoplastic splint requires frequent readjustment and remolding that can be cumbersome and time consuming.



Splinting For Cubital Tunnel Syndrome

- Cubital tunnel syndrome is the second most common site of nerve compression in the upper extremity following carpal tunnel.
- Anatomically, the ulnar nerve is susceptible to injury at the elbow. Injury to the nerve may occur as a result of trauma or prolonged or sustained motion that compresses the nerve over time.
- Symptoms include pain and parasthesias (numbness, tingling) over the sensory distribution of the ulnar nerve, the ulnar two digits of the hand.
- In advances stages, weakness and atrophy of the hypothenar muscles and thumb adductor may be seen.
- Clients are instructed to avoid repetitive or sustained elbow flexion. For this purpose, a nighttime anterior elbow extension splint is fabricated with the elbow positioned in 30 to 45 degrees of extension.
- A commercial elbow pad is helpful to protect the ulnar nerve at the elbow. The pad can be reversed and worn anteriorly as an alternative to the splint to prevent elbow flexion.